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Research Notes: A technique for evaluating nodulation response of soybean genotypes with specific Rhizobium strains

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1) A technique for evaluating nodulation response of soybean genotypes with specific Rhizobium strains.

Previous research on the interactions of Rhizobium strains with host cultivars has involved the testing of small numbers of plants with a specific strain of Rhizobium in Leonard jar assemblies (Leonard, 1943). The Leonard jar technique in our greenhouse requires frequent watering (up to twice daily) and periodic adjustment of the wick element. We have found the traditional Leonard jar assembly technique inadequate to efficiently accommodate the large plant populations required in plant selection and genetic studies of allelism and linkage.

To efficiently accommodate large plant populations we have devised an apparatus designed to minimize care and environmental variation. The apparatus was also designed to facilitate controlled infection by specific Rhizobium strains without contamination.

The apparatus consists of two elements: (1) plant growth trays suspended above and (2) a nutrient reservoir. The plant growth trays were constructed of ¼" Plexiglas cut and formed into two boxes, 22⅞" wide, 25" long, and 6" deep. The trays are filled 5½" deep with a culture medium of sterile perlite or vermiculite. In our experience, both media have proved satisfactory for soybean plant growth and have the advantage of lighter weight than the sand traditionally used. We have observed that nodule formation on soybeans was greater with vermiculite than with sand. The floor of each box was fitted with 6 tubes 2½" long, 1¾" diameter. The tubes were placed in two rows of three 5½" apart. The rows were placed at 7" and 19" in the width of

the plant growth tray. The tubes permit the liquid nutrient solution (Johnson et al., 1958) to rise by capillary action into the culture medium. The tube ends are fitted with an 18-mesh screen to retain this material. Support runners constructed of $\frac{5}{8}$" Plexiglas glued on the sides of the planter trays suspend the trays over the nutrient solution.

The reservoir or bottom container is constructed of black $\frac{1}{2}$" Plexiglas cut and formed to 24" wide, 51$\frac{1}{4}$" long, and 4$\frac{1}{2}$" deep. The black Plexiglas was used to restrict light penetration and algae growth in the reservoir. A $\frac{1}{4}$" slant in the floor of the reservoir facilitates drainage of the fluid through a brass spigot at the lowest point. The nutrient reservoir holds 80 liters of nutrient solution as a nutrient source for the plants. This reservoir holds enough fluid to expand the service period to approximately 2 weeks without replenishment.

For tests of eight weeks' duration with soybeans, each growth tray readily accommodates 3 rows of 12 seeds each for a combined total of 72 plants for each assembly. Higher plant populations may be used in tests of shorter duration or in the case of species with seedlings of small size. Seed may be inoculated prior to planting, all seed in a given assembly receiving the same strain or mixture of strains.

The plant growth tray assembly is easily cleaned and disinfected with a mixture of 50% ethyl alcohol and 50% water or other disinfectant. After disinfection, tests have shown no evidence of contamination by residual bacteria. Prolonged usage of 8 weeks or more may produce slight algae growth on the surface of the plant growth trays. This growth has not interfered with test evaluation.

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